Extra 2000

Lithium-Iron Phosphate Battery Backup

Product Manual

Information Version: 1.2

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1.1	2012.5.20	Product Updates
1.2	2013.4.10	Product Updates

Introduction

Manual Explains

Extra 2000 (V1.2) lithium iron phosphate battery is external backup power module for 48V devices. Under normal mains power, the power supply provides energy for user equipment and charging the battery; when the power supply interrupted, the battery provides energy for equipment.

Extra 2000 Product Manual exposited the basic processes and methods of the device, includes structure, parameters, installation and operation. The main contents of this manual are follows:

Chapter	Abstract
Chapter 1 Introduction	Main application and features of Extra 2000
Chapter 2 Structure and Parameters	External structure, panel description, management module parameters and others of Extra 2000.
Chapter 3 Installation and Collocation	Product installation, network usage and requires attention in installation process of Extra 2000
Chapter 4 Maintenance and Troubleshooting	Common operating status descriptions and Troubleshooting of Extra 2000

Safety Instructions

This device only be installed, operated and maintained by people who professional trained and qualified. In the process of installation, operation and maintenance, local safety regulations and related procedures must be complied, or it may result injury or equipment damage. Safety precautions mentioned in manual only as a supplement for local safety regulations. Pylontech does not assume any responsibility for breaching common security operation or equipment safety standards.

Symbols

The following format described some contents need attention for Extra 2000

Note: If warning ignored, the product may malfunction.

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1 Introduction

1.1 Introduction

Extra 2000 lithium iron phosphate battery backup is new energy storage battery products developed and produced by Pylontech according to market demand, it can be used to provide reliable backup power for various types of communication operators of 48V power supply equipments. Extra2000 is especially suitable for operating environment of high temperature, limited installation space, light load-bearing and long cycle life applications.

Extra 2000 has built-in BMS battery management system. Under normal circumstances, the main power provides energy for user equipment and charging battery; when the power supply interrupted, the battery provides energy for user equipment. Multiple batteries can be connected for larger capacity in parallel for longer duration backup requirements.

1.2 Product Features

Extra 2000 product from Pylontech is using lithium iron phosphate as cathode material, with BMS for effective management of cells. The system has the following characteristics:

- The battery is non-toxic, non-polluting and environmentally friendly;
- Cathode material is made from LiFePO4 which has safety performance and long cycle life;
- Battery management system (BMS) has protection function for status of over-discharge, over-charge, over-current and high temperature;
- The system can automatically manage charge and discharge status and balance current and voltage of each single cell;
- The centralized monitoring module is intelligent designed with three remote

functions of test, signal and control;

- Flexible configuration achieved that several battery modules can be in parallel to expand capacity and extend backup duration;
- Adopted self-cooling mode rapidly reduced system entire noise;
- Battery has less self-discharge, without charge up to 10 months; no memory effect, can be floating charge and discharge;
- Working temperature range is from -10 ℃ to 55 ℃, with excellent discharge performance and cycle life in high temperature;
- Small size and light weight, standard of 19-inch embedded design, comfortable installation and maintenance;

2 Structure and Parameter

2.1 Equipment Structure

2.1.1 Equipment Model

Table2-1 Extra 2000 Equipment Model

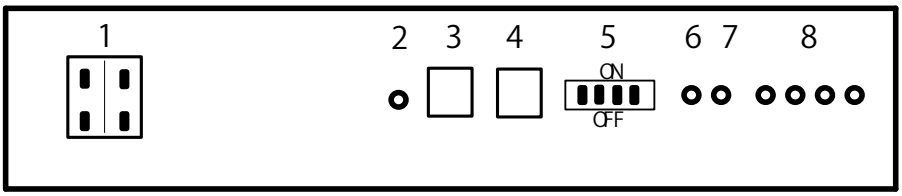
Product Series	Model	Rated Voltage	Rated Capacity	Size	Weight
Extra Series	Extra 2000	48V	50Ah	436×370×132mm	30kg

2.1.2 Equipment Front Interface Instruction

This section details the front panel of the interface functions.

Figure 2-1 Sketch of Extra 2000 Product Front Interface

Interface Protocol Standard: YD/T 1363.3-2005 " Part 3: Front intelligent device protocol of Communications Authority (Station) Power Supply, Air-conditioning and Environment Centralized Monitoring and Management Systems".



Power Port (1)

Power cord connection: the same function of two power interface in parallel. Each interface from top to bottom is anode and cathode. For each single cell, any interface can achieve charging and discharging function.

Reset (2)

Shut down button: When the battery is in storage, transportation and other non-using state, press the button to shutdown. If there is no external load or external power supply for 10 hours, it will automatically shutdown.

Communication Interface (3, 4)

- RS485 port (No. 3, Figure 2-1): when using multiple batteries in parallel, cascade each RS485 interface, information of other packs can be checked from the main pack. The definition of main battery and others please check “ADD Switch Table 2-3."
- RS232 port (No. 4, Figure 2-1): The interface is for the local network management, but can also be the docking tube interface of network with ONU devices from ZTE.

Table 2-2: Definition of RS232 Port Pin

RS232 Pin	Definition Description
1	Land
2	Veneer Reception, Computer sends

3	Veneer Sends, Computer Receives
4	Land

ADD Switch (5)

- ADD Switch: 4 ADD switches, to definite different address code for each battery module when network cascade multiple battery, up to 8 addresses. The coding and description see "Table 2-3 ADD Switch."

Table 2-3 ADD Switch

Coded Bit				Address	Pack	Description
1	2	3	4			
ON	OFF	OFF	OFF	(1)	Pack1	Master Pack, Corresponding with RS232
OFF	ON	OFF	OFF	(2)	Pack2	Slave Pack1
ON	ON	OFF	OFF	(3)	Pack3	Slave Pack2
OFF	OFF	ON	OFF	(4)	Pack4	Slave Pack3

Note: The coded bits 1 to 4 in table separately represent ADD keys from left to right. (set up for the "ON", down to "OFF"). The address of each device in accordance with the binary coded bits, 1 is low, 4 is high, Table 2-3 Example 1-4 address coding, 5-8 address and so on. If several Extra products cascading multiple network devices, the address encoding 1 is the main battery, others are assistants.

LED Status Indicators (6,7,8)

- RUN Lamp (No.6 Figure 2-1): green, long lighting when charging and flash when discharging;
- ALM Lamp (No. 7 Figure 2-1 7): red, flashes when alarm and long bright if equipment failure or protected;
- Battery capacity indicator (No. 8 Figure 2-1): 4 green lamps, each light represent 25% of capacity. The four lights lit when capacity is 100%, if 75%, the first left a lamp off, and the right three lights; if 50%, the left two lights out, the right two lights; if 25 %, the left three lights off, the right one lights.

Table 2-4: LED Indicators Instructions

Battery Statues	Protection / Alarm /	RUN	ALM	Capacity LED	Descriptions

	Normal	●	●	●	●	●	●	
Shut Down		Off	Off	Off	Off	Off	Off	All off
Standby	Normal	Flash1	Off	Off	Off	Off	Off	Indicates Standby
	Alarm	Off	Flash3	Off	Off	Off	Off	PACK Low Voltage Directive
Charge	Normal	Light	Off	Based on capacity				the right side indicator LED flashes (flash 2), others lighting
	Alarm	Light	Flash3					
	Protection	Off	Light	Off	Off	Off	Off	Stop charging, ALM lighting
Discharge	Normal	Flash3	Flash3	Based on capacity				
	Alarm	Flash3	Flash3					Indicate based on capacity
	Protection	Off	Light	Off	Off	Off	Off	Stop discharging, ALM lighting

Note: The flashing instructions, flash light 1 - 0.25s / off 3.75 seconds; flash 2 - 0.5s light / 0.5s off; flash 3 - 0.5s light / 1.5s off

2.2 Battery Management System（BMS）

2.2.1 Voltage Protection

Low Voltage Protection in Discharge:

When discharging, the protection starts if any one of the single cells has lower voltage than the setting value and the power supply stop. When voltages of all single cells return to the normal, protection removed.

Protection parameters see entry 1 of "Table 2-5 Protection Parameters".

High Voltage Protection in Charge

When charging, the system stops charging when the total voltage of the battery or any one cell over the voltage value. When total voltage and cell voltage are restored to the normal, protection removed.

Protection parameters see entry 2,3 of "Table 2-5 Protection Parameters".

2.2.2 Current Protection

Over-current Protection in Charge:

If the charging current is larger than the guard value, the system stops charging. Protection removed after the system delay time.

Protection parameters please see entry 4 of "Table 2-5 Protection function parameters".

Over-current Protection in Discharge:

When the discharge current is greater than the protection value, discharge stopped. Protection removed after the system delay time.

Protection parameters see entry 5 of "Table 2-5 Protection function parameters".

Charging Current Limit:

To ensure the load equipment working, Extra 2000 product sets the maximum charge current limit value; see "Table 2-6 Charging Parameters."

Discharging Current Limit

To protect the load equipment working, Extra 2000 sets the maximum discharge current limit; see "Table 2-7 discharge parameters." In products working, the maximum operating current of electrical load should be less than the maximum battery discharge current.

2.2.4 Additional Protection Features

Short Circuit Protection:

If short circuit occurs, the system starts short circuit protection and lasts 30 seconds.

Automatic Shutdown:

The system will shutdown automatically after 10 hours without power supply

The protection parameters of Extra 2000 see "Table 2-5 Protection Function Parameters."。

Table 2-5 Protection Function Parameters

Order Number	Type	Protective Function	Parameter to Protection	Parameter to Remove Protection

1		Low-voltage in Discharging for Cell	2.7V	3.25V
2		Over-voltage in Charging for Cell	3.75V	3. 5V
3		Over-voltage in Charging for Pack	57V	54V
4	Current	Over-current in Charging	28A	15 Seconds Delay
5		Over-current in Discharging	53A	15 Seconds Delay

2.3 Charge Parameters

When the device working, reasonable charge voltage you should set, recommended charge voltage range shown in Table 2-6. The Extra 2000 product sets the maximum charge current to protect the power supply and load equipments.

Table 2-6 Charging Parameters

Model	Voltage Range in Charging		Current Limit in Charging
	Min	Max	Max
Extra 2000	54V	57V	10A

2.4 Discharge Parameters

To protect the load equipment, Extra 2000 products limited the maximum discharge current shown in Table 2-7.

Table 2-7 Discharging Parameters

Model	Voltage Range in Discharging		Current Limit in Discharging
	Min	Max	Max
Extra 2000	42V	56.5V	50A

Note: the maximum discharge current of pack should be greater than maximum operating current of electrical load.

3 Installation and Configuration

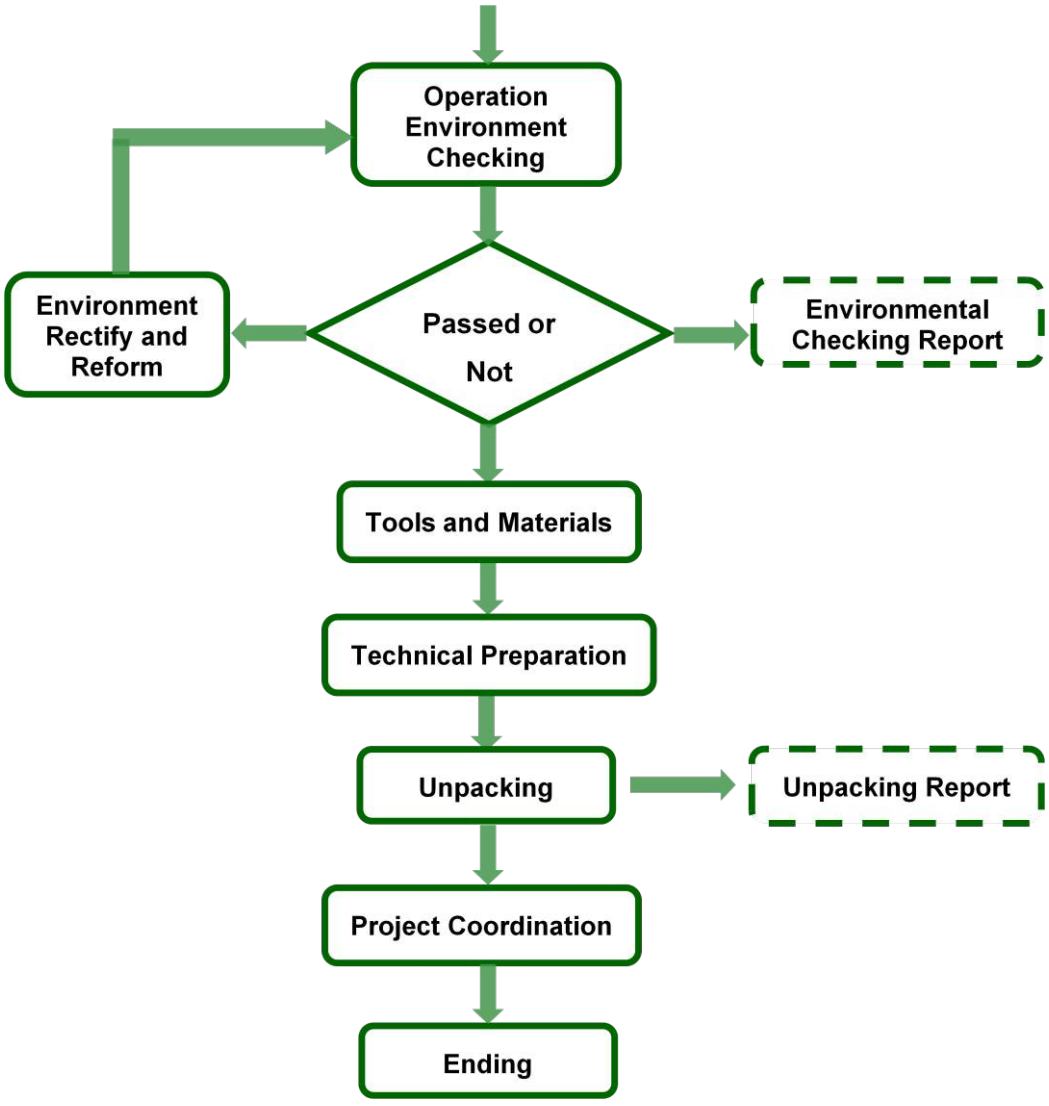
3.1 Installation Preparation

Safety Requirements

Only those who have finished training and knowledge and fully grasp the power system personnel may install the system. During installation process, one must always observe the safety requirements listed below and local safety regulations.

- All the circuit under 48V connected to the external power supply system must meet following criteria defined in IEC60950 SELV Requirements.
- If operation of the power system is in cabinet, it must ensure that the power system is not energized first, at the same time battery device must be turned off.
- Distribution cabling must be reasonable and protective measured to prevent operation of power equipment from touching these cables. Equipment installation preparation process shown in Figure 3-1

Figure 3-1 Schematic of Installation Process:



3.1.1 Environmental Requirements

Ambient Temperature: -10℃~+55℃

Relative Humidity:5%～93% RH

Altitude: Under 4000m

Working environment: No conductive dust and corrosive gas

3.1.2 Tools and Information

Hardware

Tools and instruments are shown in Table 3-1:

Table 3-1 Tools and Meters

Name	
Screwdriver (Slotted, Phillips)	Multimeter
Wrench	Clip-on Ammeter
Diagonal Pliers	Insulating Tape
Pliers	Thermometer
Clip Pliers	Antistatic Wrist Ring
Strippers	Ties

Technical Information

"Project Exploration Station Report", "Extra 2000 lithium iron phosphate Standby Power User's Manual" and "installation and inspection reports".

3.1.3 Technical Preparation

Electrical Interface Checking

Connected directly to the battery device could be user equipments, switching power supply or other power equipments. There are two typical interface device of power line:

1. DC Backup Power Interfaces

If the battery directly connects to the user device, please check:

- To check the user whether the device with DC backup power interface and whether the output voltage electrical equipment meets the requirements in voltage range of Table 2-6.
- To confirm the maximum discharge current capability of user interface to the device DC backup power, must be greater than the maximum discharge current products in Table 2-6; if not, the limiting function is required.
- To confirm the maximum operating current by battery-powered user equipment must be less than the maximum discharge current products mentioned in Table 2-7.

2. Switching Power Supply

If the battery is connected to switching power supply, it must be confirmed the positive and negative switching power connector, and measure whether the output voltage meets the requirements in Table 2-6; and also recognizing the maximum

operating current of the battery-powered load devices must be less than the maximum discharge current related products in Table 2-7.

Landing Checking

- The collocation of landing line in engine room should be furnished ground radiation or flat, it requiring three separate parts: DC power distribution systems protection, power system working and lightning protection.

- If the area can not provide three kinds of ground because space is limited, the three kinds can be merging and grounding resistance must be less than 1Ω.

Security Checking

Fire-fighting equipments must be available near the equipments such as powder fire extinguishers. For more case of requirement, it should be equipped with automatic fire extinguishing system. No flammable, explosive and other dangerous items placed next to battery.

3.1.4 Unpacking

- When equipments arrive at the installation site, before unpacking, check whether the box appearance is intact or not, and calculate total number according to freight highlighted list. Avoiding sunshine and rain, installation and disassembly must follow regulatory requirements and handling;

- To open box slightly to protect the object surface coating;

- Reading technical documents and verifying the list firstly before open the box, to ensure object is complete and intact according to the configuration tables and packing slips inventory, if the internal packaging is damaged please scrutinize and record.

3.1.5 Project Coordination

Attention of Previous Work:

- Specifications of Power Cord
  Power cord should meet the requirements of maximum discharge current of each product;
- Installation Space and Load-bearing
  To ensure there is enough space for installation, and sufficient load-bearing capacity for battery cabinet and brackets.

- Wiring

  Ensure the power cord and ground wiring is reasonable. No short circuit, water and corrosion.

3.2 Equipment Installation

Table 3-2 Installation Steps

Step 1	system powered down	
Step 2	Mechanical Installation	1. Tab Installation
		2. Equipment Installation
Step 3	Electrical Installation	1. Connecting Grounding Cable.
		2. Electrical Installation
		3. Connect the Load
		4. Communication Interface Cascade
		5. Communication Interface Collection
		6. Power Supply

3.2.1 Mechanical Installation

Before installation, disconnect the entire device's power directly contact, and recognizing that the battery is turned off (disconnect the battery power cord and press the Reset button), to ensure there is no electrification.

1 Tab Installation

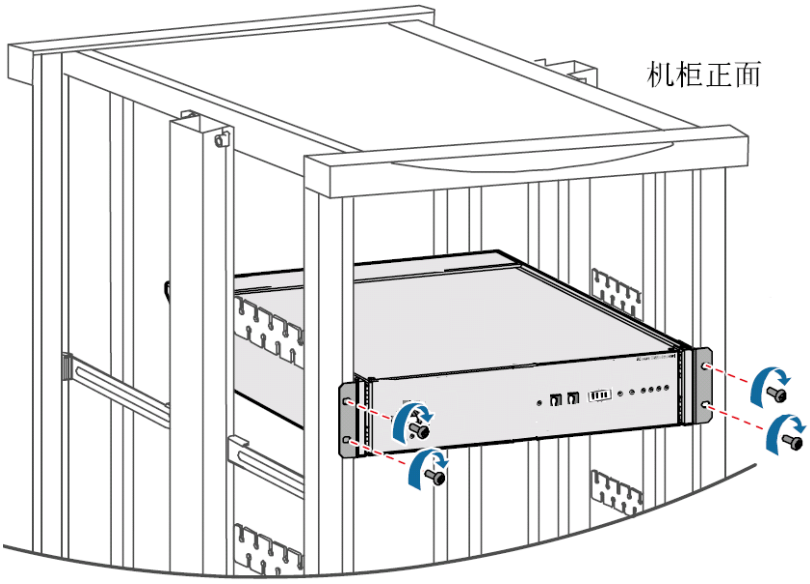
There are tabs and mounting accessories equipment box. Before the equipment fixed, install tabs on both sides of the device, and confirm screws are tightly connected.

2 Equipment Installation

Extra 2000 products using 19-inch rack-mountable, it can be installed in the

chassis designed with battery, and also be installed in the cabinet. Put device in parallel on the pallet rack, push it into the cabinet to make a very tight against between tab and the mounting bracket, tighten with screws and floating nuts, it must be ensure that all devices are secure. The position is flexible according to the actual for arrangements device in a cabinet.

Figure 3-2: Schematic of Device Fixed to the Cabinet



3.2.2 Electrical Installation

Before connecting power and landing, using multimeter to measure cable continuity, short circuit, and confirmed anode and cathode, and make the cable labels.

Measuring methods:

- Cable continuity: Select buzz file of multimeter with a probe touch the ends of the same color cable, if buzzer means cable is available.
- Short circuit: Select resistance profile of multimeter, with a probe measuring the same anode and cathode, if the resistance displayed infinite, means cable is available.
- Anode and cathode: after power cord connected, the battery positive and negative should be connected respectively positive and negative of equipment.

Cables connection order:

1 Ground Cable

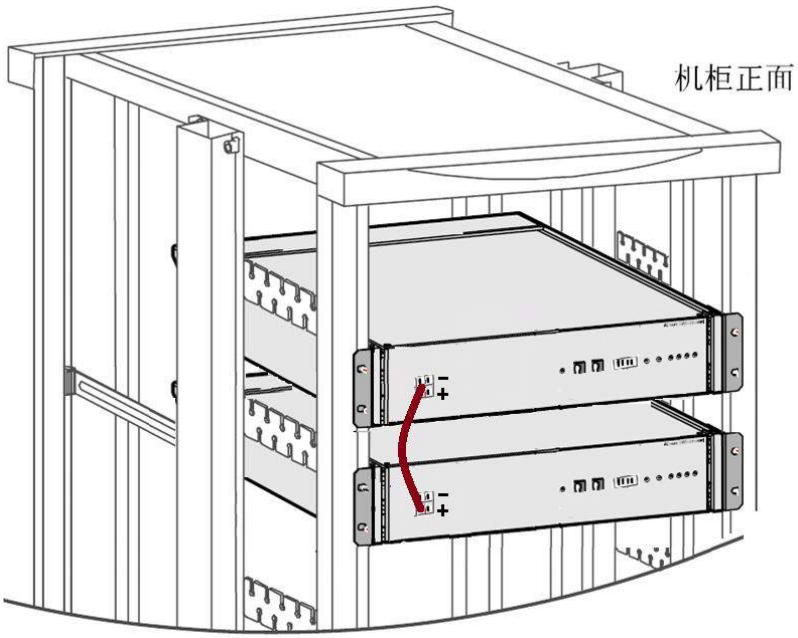
Connect one side of the cable to the copper rafts to ground, and the other side connect to the hole placed on right interface back of battery chassis with 4mm^2 line connection, make sure connections are tight and well grounded.

2 Batteries in Parallel

Please kip this step and go to Step 3 when using a single battery.

When using multiple batteries in parallel, firstly parallel each station batteries with the power cord. Extra 2000 product has 2 power interfaces on left front panel device, power connector from top to bottom are negative and positive. The 2 interfaces have same function, when multiple batteries in parallel, using parallel power cable to connect each battery. After parallel, any free battery power interface can connect load.

Figure 3-3 Multiple Batteries in Parallel Power Line Connection Diagram:



3 Load Connected

When connect load, connect the user equipment side power line interface first, and then the battery power supply interface.

(1) Connection of battery and the load device in DC backup power interface

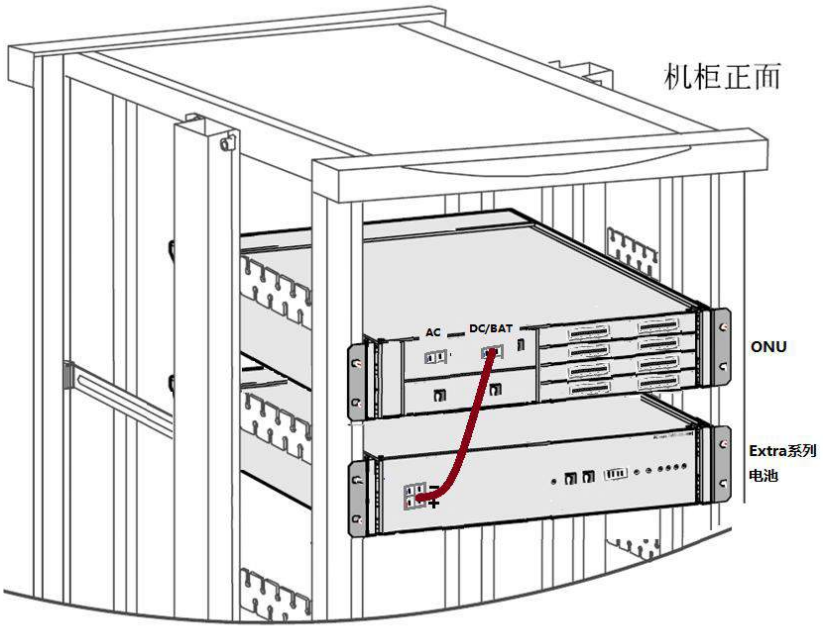
If the load device has a DC backup power interface, this installation can be used.

Single load equipment: the power cord directly connected to the load equipment

DC backup power interface.

Multiple load equipment: use a division multiple power cords and the power cord directly connected to each of the DC backup power load device interface.

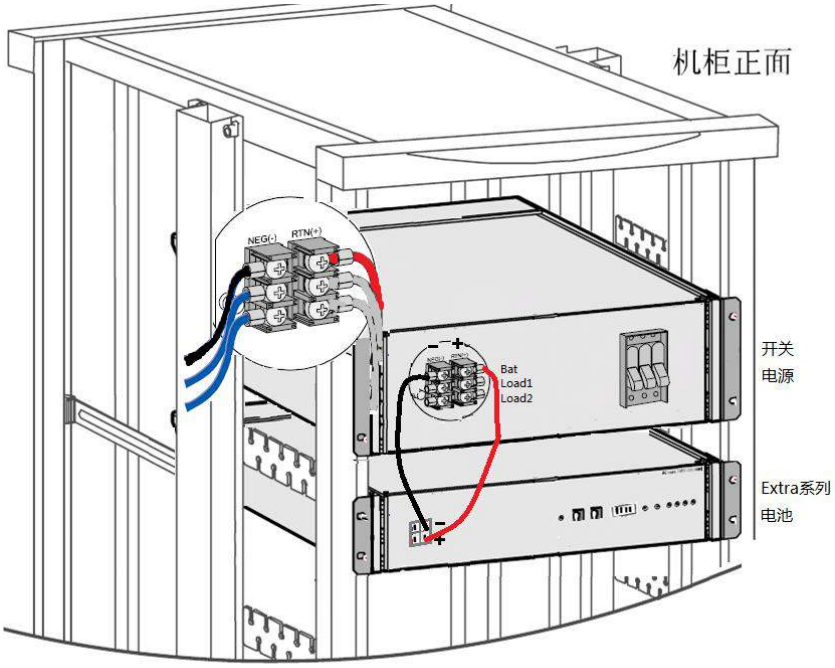
Figure 3-4 Connection Diagram Interface between Battery and Load Equipment of DC Backup Power



(2) Connection of the Battery and Switch Power

This installation method can be used when switching power supply to loads. Installing the battery power cord priority access battery interface first; if switching power supply without a battery interface, the power line can also be inserted interface of load power supply, it should pay attention to that maximum load current should be greater than the maximum discharge current of relevant battery in Table 2-7.

Figure 3-5 Battery and Switch Power Connection Diagram



Note:

- Confirm the positive and negative of switching power supply before connecting, the red power wire to positive and black one to negative;
- Before connecting, verify the charging parameters of interface switching power supply battery. Voltage and current should satisfy charging parameters in Table 2-6 Battery.

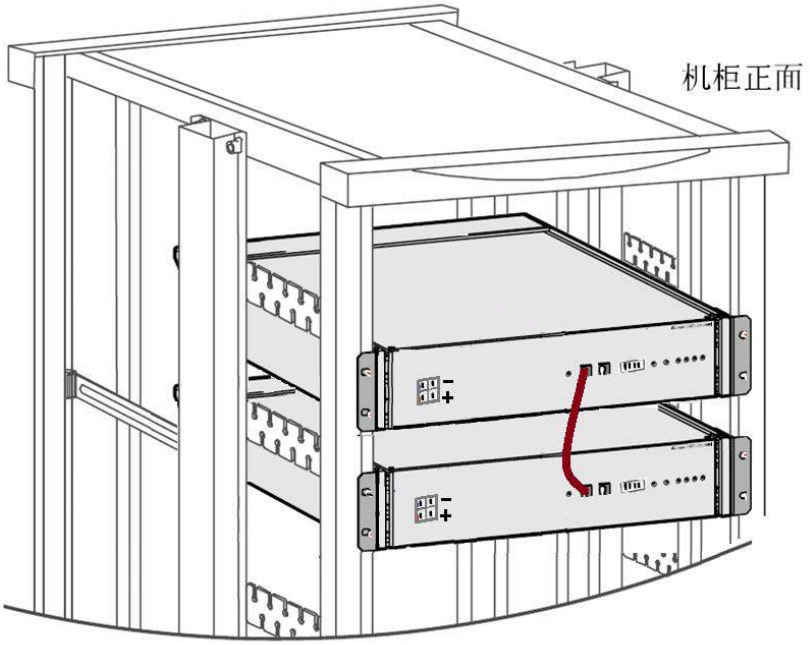
4 Cascade Communication Interface

If using a single station battery, please skip this step and proceed to step 5;

When using more than one battery, please continue with this step. (If not using the net management, this step is not required)

To check network management information of all batteries through one battery, please parallel each battery through RS485 interface. UTP—Unshielded Twisted Pair (line order: 568b) is used to connect two batteries of the RS485 interface. When there are more than two, the junction box is used to parallel each interface. After cascading, ADD switches is used for each battery sequentially assigned address code starting from 1, the ADD switches using refer to the on slip 5 "ADD switch" in manual "2.1.2 Equipment Front Panel".

Figure 3-6 Cascading of Multiple Batteries in Parallel Network Schematic



5 Communication Interface Connection

If using the local network, put the specially equipped RS232 communication cable to connect the battery and computer serial RS232 interface.

If multiple network cascade battery, connect the battery RS232 interface with ADD Address is 1.

6 Powering on Device

After completing these steps, turn on power to the entire system to activate the battery, installation completed.

Note:

After power on, if found ALM indicator in front panel red continuously over 5 seconds, disconnect the power cord to the battery and shutdown the battery, re-check whether the device is properly connected and the positive and negative terminals are correctly connected.

4 Using, Maintenance and Troubleshooting

4.1 Alarm Description and Processing

When protection start or failure, the ALM indicator on the front panel will alarm, through net management can query specific alarm class and take appropriate action.

4.1.1 The Alarm and Countermeasure Influence System Output

Please follow Table 4-1 processing if output of the fault appears such as over-voltage, charge over-current, under-voltage protection, high-temp protection and other abnormalities.

Table 4-1 Major Alarm and Protection

Statue	Alarm Category	Alarm Indication	Processing
Charging	Cell Over-voltage	ALM Lighting	Stop charging and find the cause
	Over-current	ALM Lighting	Stop charging and find the cause
	high-temp	ALM Lighting	Stop charging
Discharging	Over-current	ALM Lighting	Stop charging and find the cause
	high-temp	ALM Lighting	Stop discharging
	Low Total Voltage Protection	ALM Lighting	Start charging
	Cell Voltage Protection	ALM Lighting	Start charging

4.1.2 The Alarm and Countermeasure do not Influence System Output

If it appears the low total voltage alarm or low single cell voltage, the battery system also generates the corresponding alarm signal. Maintenance personnel

should inspect equipment according to prompt information, and determine the fault type and location, and take appropriate measures to ensure the system is in the best working condition, not to affect the system output. Phenomenon and countermeasures are shown in Table 4-2.

Table 4-2 Secondary Alarm

Category	Alarm Indication	Countermeasures
Low Total Voltage Alarm	ALM Flashing	Stop Discharging
Low Cell Voltage Alarm	ALM Flashing	Stop Discharging

4.2 Common Fault Analysis and Solutions

Common fault analysis and solutions shown in table 4-3:

Table 4-3 Common Faults and Solutions

Number	Fault Symptom	Reason Analysis	Solution
1	DC power supply time shorter	Battery capacity reduced	Change storage battery
2	Battery cannot be fully charged	Low voltage in charging	Adjust charging voltage in 54V～56.5V
3	Fire sparkle appeared when power up, alarm lamp lighting	Short circuit	Shutdown system, check the cause and exclusion

Related special difficulties or questions of technology, please contact Pylon Technologies Co., Ltd.